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NOTES ON MANGANESE IN CANADA.

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In preparing the following brief sketch of the various important deposits of manganese in Canada, I have embodied the greater part of the article on that substance which I prepared for the annual report of the division of Mineral Statistics and Mines for 1890.*

That the industry has not attained greater commercial prominence is due rather to its distance from market than to any insufficiency of supply; this applies, however, more especially to

*Annual Report Geol. Surv., part S, Vol. v, 1889-90.

the low grade or blast furnace ores than to the highly crystalline pyrolusite for which the market is restricted. Of the geographical position of the ore deposits little need be said beyond the fact that the worked and, as far as is yet known, the workable deposits are all situated within New Brunswick and Nova Scotia. Throughout these provinces are found many comparatively extensive deposits of the crystalline and semi-crystalline ores, viz: pyrolusite, manganite and psilomelane, as well as large areas of wad or bog—manganese. The crystalline ores are, in the majority of cases, found in rocks of Lower Carboniferous age, while the bog ore deposits, being of recent formation, are found overlying rocks of any formation from the pre-Cambrian upwards.

New Brunswick.—In New Brunswick the most important deposit of the crystalline ores is that at Markhamville, Sussex, Kings Co., from the workings of which upwards of 20,000 tons have been shipped. The ore deposits are irregular beds, pockets and veins in a small area of Carboniferous limestone, on the northwest side of which are located the workings. Many of these ore bodies have attained large dimensions, one of them affording in the neighborhood of 4,000 tons of manganite with a considerable proportion of pyrolusite. The discovery of manganese at this point was made in 1862, when it was worked by Mr. Wm. Davidson, of St. John, until 1865, after which the property passed into the hands of the Queen Manganese Co., by whom it was operated under the management of Major A. Markham until 1889, when it again changed hands and was operated, still under Major Markham, by the Pope Manganese Co. Owing to the location of the deposits, in a valley cut through the softer limestones, no regular system of mining has been attempted, the operations being, until quite recently, altogether in the form of drifts and open cuts with which the hill on the north and west side of the property is literally honey-combed. During 1890, however, explorations were being made by means of the diamond drill, with the result that two deep-seated deposits had been found and were being sunk upon.

Of the ore shipped from this mine two distinct classes are recognized, viz: "Blast furnace ore," consisting almost entirely of manganite, and high grade or "grey ore," consisting of pyrolusite. The following analyses are of "high class manganese ore from Markhamville, New Brunswick" and are taken from "The

Mineral Resources of the United States, calendar year 1888." Washington, 1890:

	No. 1.	No. 2.	No. 3.
Manganese binoxide	98.70		
" peroxide		97.25	96 62
Silica	0.55		
Iron	0.75		
Iron peroxide		0.85	0.78
Barium	trace		
Baryta and silica		0.95	0.85
Water		trace	trace
Loss		0.95	1.75

Another important deposit of crystalline ore is that of Jordan mountain about five miles north of Sussex, Kings Co., and on the western side of the mountain. The ore bodies occur in a manganiferous limestone throughout which are scattered, in a manner similar to that at Markhamville, more or less extensive deposits of pyrolusite and manganite. Since its discovery in 1882, by the present owner, Mr. F. W. Stockton, of Sussex, but little has been done, further than a small amount of development work, consisting of stripping and an open cut of about eighty feet in length, in the bottom of which might be seen an interbedded lenticular mass of ore, principally manganite. From this cutting about 400 tons of eighty to eighty-five per cent. ore had been extracted.

Operations have been carried on for many years and by different companies at Quaco Head, a bold rocky promontory about one mile southwest of the village of St. Martins, Kings Co., unfortunately, however, with but slight success, owing to the low percentage of ore contained in the rock mass. The deposit consists of a heavy bed of red calcareous shale highly charged with manganite and psilomelane, pyrolusite being of much rarer occurrence than in the limestone deposits of the aforementioned localities. The property has been worked in a very desultory manner for many years, energetic operations not having been undertaken until its acquisition by the present company, who began work by driving a tunnel into the shales which show a bluff face of about 150 feet high. From this tunnel, which was driven about sixty feet, two cross-cuts were made in either direction for about twenty feet. In these workings several small pockets and considerable quantities of mill-rock were struck and the ore extracted, though no shipments were made. In connection with the mine a well equipped mill was erected and a wharf built and

all facilities made for the easy handling of the ore. Owing to the position of the mine, ore could be run direct from the workings to the wharf and loading accomplished at one handling by means of self-dumping cars.

Assays of the concentrated ore made by A. M. Cowly, Cambridge, Mass., gave the following result:

	Compact variety.	Porous variety.
Manganese dioxide	71.54	65.00
Insoluble silicates	8.37	6.66
Ferric oxide	2.19	1.75
Phosphorus	0.02	0.04
Calcium	trace	trace
Metallic manganese	58.20	57.15

A considerable proportion of lime is generally present in the concentrates, which will not, however, interfere with their fitness for use in the manufacture of steel for which purpose all the ore from this property will be most suitable.

A peculiar occurrence of manganese is that which is to be seen on the north and northeast side of Gowland mountain, Elgin, Kings Co., where the ore, consisting principally of psilomelane, is found filling the interstices of a very much broken and partly decomposed granite of pre-Cambrian age. A small amount of development work was done on these deposits without, however, locating any other than small bunches of a very impure pyrolusite and psilomelane. The following analysis made in 1885 by Mr. F. D. Adams, late assistant chemist to the Geological Survey, is that of a specimen of psilomelane from this property:

Manganese dioxide, available	50.21 per cent.
Ferric oxide	3.06 "
Insoluble residue	33.78 "

The specimen also contained a very appreciable percentage of baryta.

This property is peculiar in affording the only instance in New Brunswick where the crystalline ores of manganese are known to occur in appreciable quantity outside of the Carboniferous areas.

Other localities where manganese, in its crystalline forms, have been noted are, Upham, Waterford, near Petitcodiac, Springfield, Tête-à-Gauche Falls, and many points throughout Albert county. Of one of these, Shepody mountain, Dr. R. W. Ells, in his report to the Geological Survey for 1884, writes: "The rocks of the mountain (Shepody mountain) rest upon a small outlier of the

talco-chloritic schists, which show on the road to the north, leading to Curryville, and are flanked on the east by the grey sandstones of the millstone-grit. On the northwest side a large deposit of manganese was worked for some years, a tunnel being driven into the mountain along the contact with the underlying schists for nearly 1,000 feet, the ore, which consisted of pyrolusite and psilomelane, occurring at the base of the conglomerate in irregular pockets. Operations have been suspended for some years, and the workings have all fallen in."

Of the deposits of wad in New Brunswick the most important are those at Dawson Settlement, Albert Co., where many acres of ore are found, the beds varying in extent and depth, and attaining in some places a thickness of over forty feet, to which point they have been proved. The deposits are covered throughout with peat and peaty matter, having a thickness of about twelve to twenty inches, the ore beneath this being found to be practically free from impurities. The mode of working is very simple, consisting of cross trenching, by which means the deposits are drained, after this the ore is excavated and dried in pans, the result being a dry and almost impalpable powder.

A partial analysis of the ore by Mr. W. F. Best, of St. John, gave:

Manganese binoxide	47.0
Iron oxide	18.0
Vegetable matter	34.0
Loss	1.0
Copper	trace
Cobalt	trace
	100.0

Several analyses by Mr. John Burwash gave the following percentages of manganese binoxide: 73.6, 35.5, 58.3, 57.6, 70.7, 63.4, and an average specimen collected at various points and sampled gave 47.4.

Nova Scotia.—As in New Brunswick extensive deposits of manganese are known to exist in Nova Scotia, where the ores and mode of occurrence are similar though differing in a great measure in the matter of production, that of this province being much smaller than that of New Brunswick. In Nova Scotia, however, there is a very large proportion of pyrolusite or high grade ore.

On the south shore of Minas Basin and midway between Noel

and Walton, is situated the best known and most important manganese mine in Nova Scotia, the Teny Cape mine, which, since its discovery in 1862, has been operated more or less continuously. The ores, consisting mainly of pyrolusite and manganite, are found in the Carboniferous limestone which may be traced for many miles on the south shore of Minas Basin, the limestone immediately in connection with the ore deposits being highly manganiferous and interstratified with small beds and masses of manganiferous calc-shale, the whole being usually of a deep red color. The mode of occurrence is pockety, the ore being found in irregular masses and stringers which follow the bedding planes and fractures; some of these pockets are of considerable extent, one affording, it is said, upwards of 1,000 tons of high grade ore, principally pyrolusite. A very considerable proportion of all the ore extracted from this mine has been pyrolusite worth from $100 to $125 per ton at the works, and containing from 85 to 95 per cent. of available binoxide.

The following assays taken from an article entitled "Notes on the Manganese ores of Nova Scotia," by E. Gilpin, Jr., show the character of the ores obtained from Teny Cape and vicinity:

	Teny Cape (*a*)	Cheverie (*b*)	Douglas
Manganese oxides	85.54	90.15	84.62
Iron peroxide	1.18	2.55	0.60
Baryta	0.89	1.12	0.72
Insoluble matter	3.27	2.80	1.73
Phosphoric acid	0.34	1.03	
Water	8.54	2.05	5.29
Oxygen			7.04
	99.76	99.70	100.00

(*a*) Analyst, Dr. Howe.
(*b*) " E. Gilpin, Jr.
(*c*) " H. Poole.

Deposits similar to that at Teny Cape have been worked to a smaller extent at Cheverie, Walton, Noel and Shubenacadie, on the south shore of Minas Basin, while on the north shore no important deposits of manganese have been noted, though some of the limonite and other iron ores of the neighborhood of Londonderry are highly manganiferous; this is also the case with many of the iron ores of both Colchester and Pictou counties.

The following assays, taken also from Mr. Gilpin's article mentioned above, show the character of some of these ores, the par-

ticular cases cited here being of two limonite ores from Springville, Pictou county.

Iron sesquioxide	10.848	48.223
Manganese oxide	62.950	
" peroxide		14.410
Magnesium	1.630	
Lime	7.280	0.015
Alumina	2.880	Trace
Baryta	0.670	
Sulphur		0.480
Phosphorus		0.020
Insoluble residue	2.731	25.130
Water of composition		12.530
Moisture	1.450	
	90.439	100.808

On Cape Breton island as well as on the main land of the province are found deposits of manganese, some of which attain considerable dimensions. Among the more important of these may be mentioned those situated near Loch Lomond, and of which Mr. Hugh Fletcher reports as follows: Geological Survey report, 1882-84:

"Large deposits of pyrolusite, which promise to be of great importance, have recently been discovered and developed by the Hon. E. T. Moseley, of Sydney, on the south side and near the head of Loch Lomond, in Cape Breton county. The ore is associated with lower Carboniferous rocks and has been worked in two places about three-quarters of a mile apart. At the most easterly of these, in a brook on the farm of Norman Morrison, a tunnel has been driven about thirty feet on a vein about seven inches thick, dipping N. 87° W. $< 25°$ in fine red sandstone overlying reddish and greenish grit, with grains of quartz about the size of wheat and red marly sandstone. The ore is irregularly mixed with red and grey bituminous limestone, red and greenish shale conglomerate and other rocks blotched with calc-spar. It is in lenticular layers and also intimately mixed with the limestone, being probably of the same nature and origin as the hematite and forming at times a cement for the pebbles of the conglomerate * * * The mines were first worked in 1880. In 1881 about 70 tons, and in the following year 59 tons of excellent ore were shipped to the United States, * * * An analysis of a sample from the Morrison mine afforded Mr. Adams 91.84 per cent. of manganese dioxide, only .12 per cent. of ferric oxide and 2.91 per cent. of insoluble residue."

Many other deposits, both of crystalline ores and wad, are known to exist throughout the island. One of these on Boularderie island is said to be quite extensive, and the character of the ore may he judged from the following assays:

	I.	II.	III.
Manganese peroxide	25.42	11.04	44.33
Iron sesquioxide		12.49	35.50
Insoluble matter		57.76	10.00
Water	33.52		

I and II by G. C. Hoffmann, Chemist Geological Survey. III by E. Gilpin, Jr., Trans. Royal Society of Canada, Vol. II, sec. IV.

Ontario and Quebec.—Outside of Nova Scotia and New Brunswick but little manganese is known to occur, and where noted is usually of low grade. In Quebec several small deposits of wad have been noted, the largest, perhaps, being that in Stanshead township, where on lot nine, range ten, the ore covers an area of about twenty acres, and has a thickness of about twelve inches. That this deposit has but slight commercial value is evidenced by the fact that the washed ore contains only 37% of peroxide. Another deposit, similar to the above, occurs on lot twenty, range twelve of Bolton, the ore there assaying 26%. Many similar deposits might be mentioned, though probably none as important as those noticed above.

Manganese has also been noted as occurring on the Magdalen islands, a small group in the gulf of St. Lawrence. Of these deposits Mr. Jas. Richardson in the report of the Geological Survey 1879-80, writes: "Immediately under Demoiselle hill, on Amherst island, numerous blocks charged with peroxide of manganese, or pyrolusite, occur among the debris of the fallen cliffs. They are in pieces varying from one pound to ten or fifteen pounds in weight. There can be little doubt that they are derived from a deposit more or less regular in the hill side, but which is now completely concealed by the fallen debris. At a place bearing nearly due west from Cap aux Meules, at a distance of about a mile, and close to the English Mission church, similar pieces to those above described are very frequently picked up." Assays of this ore, in the same volume, gave:

Manganese dioxide	45.61 per cent.
Water, hygroscopic	0.10 "

In Ontario manganese has been reported from Batchewaherung bay, lake Superior. The ore is manganite and is said to assay as

high as 60% of peroxide; of the extent and exact situation of the deposit it is not possible to write.

An interesting discovery of a manganiferous spothic iron ore is reported by Dr. R. Bell in the report of the Geological Survey 1877-78, wherein he states that a band of about twenty feet of the ore, carrying 25% metallic iron and 24% carbonate of manganese, occurs in the Nastapoka islands, a group off the east coast of Hudson bay. The ore is easily accessible and will no doubt eventually prove of value, the high percentage of manganese contained making it eminently suitable for the manufacture of speigeleisen.